REMARKS

As recited in above-amended Claim 1, an aspect of the present invention is a hot plate for heating a wafer comprising a ceramic substrate in disc form, said ceramic substrate having a lower face and an upper face, wherein a resistance element pattern having a thickness dispersion of ±3 μm or less is formed on the lower face of the ceramic substrate.

In order to improve temperature uniformity of a heating surface of a hot plate, it is more preferable to form a resistance element on the lower face of a ceramic substrate than to bury the resistance element inside the ceramic substrate. As illustrated by the **attached** Figs. A and B, thermal diffusion is more effectively realized when the resistance element is formed on the lower face of the ceramic substrate since the distance between the resistance element and the heating surface is longer.

However, when the resistance element is formed on the surface of the ceramic substrate, the surface of the resistance element, the side which does not contact with the ceramic substrate, becomes rough so that dispersion in the thickness of the resistance element gets large. As a result, variation in the value of resistivity of the resistance element is generated and deteriorates the temperature uniformity of the heating surface.

According to the present invention, uniform thickness of the resistance element is ensured by, for example, employing a dry process (Claim 17) or scaly noble metal powders (Claim 23). A dry process is a method which enables depositing atoms directly on the surface. The resultant film formed on the surface has a high flatness. Scaly noble metal powders are used to prepare a resistance element paste which is printed on the surface and forms a layer with a high flatness. Either of the above methods produces a resistance element pattern having a thickness dispersion of ±3 μm or less.

By decreasing the thickness dispersion, the temperature uniformity of the heating surface is realized. Such a small thickness dispersion has never been realized in the prior art.

The effect of the present invention is clearly shown from the comparison in the specification at page 13, line 7ff, of Samples 1-4, which are according to the present invention, and Sample 5, which is for purposes of comparison. The resistance elements of Samples 1-3 were formed by a dry process. The resistance element of Sample 4 was made of scaly noble metal powders. The thickness dispersions of the resistance elements of Samples 1-3 were ±1 μm or less, and were +0.7 μm, +0.5 μm and -0.3 μm, respectively. The thickness dispersion of the resistance element of Sample 4 was +2.0 μm. On the other hand, the resistance element of (comparative) Sample 5 was made of a commonly used silver paste. The thickness dispersion of the resistance element of Sample 5 was +3.1 μm.

Regarding the uniform heating of a wafer, and as described in the specification at page 15, line 7ff, the value of the dispersion in the temperature were within 0.2°C, 0.15°C, 0.1°C and 0.25°C in the tests of Samples 1, 2, 3 and 4, respectively. On the other hand, in the test of Sample 5, the value of the dispersion in the temperature was 0.4°C or less, clearly larger than the results of other Samples.

The above-discussed comparative results could not have been predicted by the applied prior art.

The rejection of Claims 1-4 under 35 U.S.C. § 102(e) as anticipated by U.S. 4,574,292 (Takikawa et al) is respectfully traversed. Takikawa et al discloses a thermal head having a substrate and a heating resistor of a thin film type formed thereon. The thermal head is intended to be used in thermal character recording. The present invention differs from Takikawa et al on a number of levels. The present invention is drawn to a hot plate, not a thermal head. The present invention requires a resistance element pattern, while the thin film heating resistor of Takikawa et al is in the form of a film not apparently having any pattern. The present invention requires a substrate in disc form, while Takikawa et al discloses a heating resistor having a size of 100 μm X 100 μm (column 5, lines 13-14), suggesting a

square shape. In the present invention, the upper face of the ceramic substrate, opposite to the lower face on which the resistance element pattern is formed, is the heating surface; in Takikawa et al, heating is performed on the side where the heating resistor is formed.

To the extent the Examiner determines that the presently-claimed invention, if not anticipated by Takikawa et al, is nevertheless unpatentable over Takikawa et al, it is respectfully submitted that Takikawa et al is non-analogous art.

For all the above reasons, it is respectfully requested that the rejection over Takikawa et al be withdrawn.

The rejections under 35 U.S.C. § 103(a) of:

Claims 1-5 and 13 over U.S. 4,804,823 (Okuda et al);

Claim 6 over Okuda et al, and further in view of U.S. 5,118,983 (Morita et al); and

Claim 7 over Okuda et al, and further in view of U.S. 3,576,722 (Fennimore et al) or U.S. 5,442,239 (DiGiacomo et al),

are all respectfully traversed.

Okuda et al discloses a ceramic heater comprising a ceramic substrate, and a heat-generating resistor disposed in the interior of the ceramic substrate or on the surface of the ceramic substrate (column 2, lines 38-42). A paste for a heat-generating resistor contains TiN, Si_3N_4, Y_2O_3, MgO and Al_2O_3. The paste is screen printed on the surface of a formed body (column 8, lines 8-35). The paste does not contain scaly noble metal powders.

The heat-generating resistor according to Okuda et al corresponds to the resistance element of above-discussed (comparative) Sample 5. As discussed above, the resistance element of Sample 4 according to the present invention, which is made of a scaly noble metal powders, has a thickness dispersion of +2.0 μm. On the other hand, the resistance element of Sample 5 has a thickness dispersion of +3.1 μm, causing a large value of dispersion in the

temperature. The heat-generating resistor according to Okuda et al necessarily has a large value of dispersion in the temperature.

Moreover, as clearly shown in Figs. 2 and 3 of Okuda et al, the ceramic substrate does not have a disc form, but has a rectangular form. The ceramic heater according to Okuda et al is not suitable for heating a wafer.

Morita et al relates to a thermionic electron source used for an electron gun, a hot cathode X-ray tube or the like. As shown in Fig. 1 therein, the high temperature operating element comprises a ceramic substrate 1, a resistive film 2 on the lower face of the ceramic substrate, and an element film 4 on the opposite face of the ceramic substrate. The element film 4 is heated from the rear and emits electrons (column 5, line 57 to column 6, line 3).

The Examiner relies on Morita et al for a disclosure of noble metals, although Claim 6 requires scaly noble metal powder. Nevertheless, even if Morita et al were combined with Okuda et al, the result would still not be the presently-claimed invention. Morita et al discloses and suggests nothing regarding temperature uniformity of the heating surface. One skilled in the art would learn nothing from Morita et al that the temperature uniformity of a heating surface can be achieved by adjusting the thickness dispersion of the resistance element, and how to form such an element, such as by a dry process and the like, within ±3 μm.

Fennimore et al discloses a method for metalizing ceramics which relates to production of microcircuitry (column 1, lines 31-33). The method according to Fennimore et al includes the step of applying a refractory metal (titanium) to a ceramic (aluminum oxide) substrate (column 1, lines 43-45). The titanium film is applied by vacuum deposition accomplished through sputtering or by evaporation using an electron beam gun (column 2, lines 22-26).

DiGiacomo et al relates to structure and method for corrosion- and stress-resistant interconnecting metallurgy. Fig. 1 shows a metal film structure deposited on a substrate. The film comprises a layer of chromium, a layer of nickel, and a layer of noble metal (column 4, lines 46-57).

It is not clear why one skilled in the art would combine Okada et al and Fennimore et al or DiGiacomo et al, but even if combined, the result would still not be the presently-claimed invention.

First, it is highly unlikely that the formed film of Fennimore et al functions as a resistance element. Second, Fennimore et al does not disclose that their titanium film is formed by screen printing. On the other hand, Okuda et al discloses forming a heat-generating resistor by screen printing (column 8, lines 8-35). Accordingly, there is no motivation to combine Fennimore et al with Okuda et al to form a titanium layer on a surface of a ceramic substrate by screen printing.

DiGiacomo et al is drawn to a semiconductor component, e.g., a chip (column 4, lines 32-35), not a hot plate, and neither discloses nor suggests that the metal film can be used as a resistance element. DiGiacomo et al discloses that the metal layers can be formed by sputtering (column 4, lines 47-50), but is silent about the thickness dispersion of the metal layers. Since DiGiacomo et al fails to disclose or suggest a hot plate, or that their metal film can be used as a resistance element, there is no motivation to combine DiGiacomo et al with Okuda et al to form a resistance element comprising a chromium layer.

Indeed, neither Fennimore et al nor DiGiacomo et al disclose or suggest anything about a hot plate for heating a wafer, or the effect of the present invention, whereby temperature uniformity of the heating surface is achieved by adjusting the thickness dispersion of the resistance element within ±3 μm.

As Claim 1 and the claims dependent thereon have been shown to be patentable over the applied prior art, new Claims 7 and 23, and claims dependent thereon, are patentable as well.

For all the above reasons, it is respectfully requested that these rejections be withdrawn.

Applicants respectfully call the Examiner's attention to the Information Disclosure Statement (IDS) **submitted herewith**. The Examiner is respectfully requested to initial the Form PTO 1449 submitted therewith, and include a copy thereof with the next Office communication. Applicants also respectfully call the Examiner's attention to the List of Related Cases **submitted herewith**.

Applicants gratefully acknowledge the Examiner's indication of allowability of the subject matter of Claims 8 and 9. Nevertheless, Applicants respectfully submit that all of the presently-pending and active claims in this application are now in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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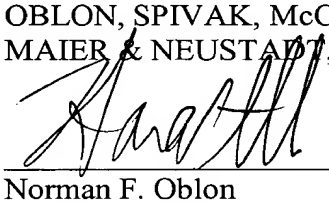

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